REMARKS

In the Office Action, the Examiner rejected claims 1, 2, 4-8, 11, 12, 14-20, 22, and 24 pursuant to 35 U.S.C. § 103(a) as unpatentable over Leavitt, et al. (U.S. Patent No. 6,491,634). Claim 9 was rejected pursuant to 35 U.S.C. § 103(a) as being unpatentable over Leavitt, et al. in view of Little, et al. (US 2004/0133110). Claims 10 and 13 were rejected pursuant to 35 U.S.C. § 103(a) as being unpatentable over Leavitt, et al. in view of Pflugrath, et al. (U.S. Patent No. 6,102,863). Claim 23 was rejected pursuant to 35 U.S.C. § 103(a) as being unpatentable over Leavitt, et al. in view of Pflugrath, et al. and further in view of Ramirez (US 5,627,536).

Applicants respectfully request reconsideration of the rejections of claims 1-2, 4-17, 19-20, and 22-24, including independent claims 1, 11, 16 and 20.

Independent claim 1 recites an analog-to-digital converter between the transducer and the releaseable connector where a coaxial cable connects the ultrasound transducer to the analog-to-digital converter and a housing connects with the end of the coaxial cable and is at least partially around the releasable connector and the analog-to-digital converter.

Leavitt, et al. do not disclose these limitations. Leavitt, et al. provide an ultrasound system 102 connected via a cable 104 to a probe assembly 106 (col. 3, lines 31-35; and Figure 1). Both the transducer 202 and the analog-to-digital converters 214 are in the probe assembly 106 (col. 3, line 62-col. 4, line 3; col. 4, lines 22-31; Figures 1 and 2). The analog-to-digital converters 214 are part of electronics in the probe assembly 106 to reduce the number of signals to be communicated over the cable 104 to the ultrasound system 102 (col. 3, lines 42-52; and col. 4, lines 53-56). Leavitt, et al. provide a probe assembly with analog-to-digital converters, shown in one housing (Figures 1 and 2), where the cables connect from the probe housing 106 to the ultrasound system 102. Leavitt, et al. teach the transducer, analog-to-digital converter, cable, and cable releasable connector in a different order than claimed. Leavitt, et al. do not provide for a connector housing covering at least part of both

the releasable connector and the analog-to-digital converter where a cable connects the ultrasound transducer to the analog-to-digital converter.

The Examiner notes that a change in shape, portability, and separability do not render an application novel. In particular, the cables are alleged to constitute only the electrical connection, and the portions of the housing around the transducer and the A/D converter/connector can be considered separate from the imaging system housing as they are electrically connected in the Figures as separate portions of the schematic.

The separate blocks of the schematic of Figure 2 are shown in a same box 106 labeled as a probe (Figure 2). The probe 106 is a single housing, as represented in Figure 1, and known in the art. The probe 106 includes parts that are assembled together, being noted as an assembly in the specification (col. 3, lines 33-40). The probe 106 is held by the user to scan a patient, so would not be separated by a person of ordinary skill in the art. Separation would cause ergonomic problems due to the number of cables. The cables used for these signals are coaxial cables. Since an array is used, many coaxial cables result. Coaxial cables are heavy, so a fewer number are sought (col. 1, lines 37-41). A person of ordinary skill in the art would not have added cables between the components to avoid the weight.

The analog-to-digital converters 214 are next to the transducers 202 to allow sub-beamformation, which reduces the number of cables to be used (col. 3, lines 49-52 and col. 4, lines 53-56). Separating the analog-to-digital converters 214 from the transducers 202 by coaxial cables instead of circuit board signal traces would defeat the very purpose for the position of the analog-to-digital converters 214 in the probe 106. A person of ordinary skill in the art would not have used coaxial cables between the components within the probe 106 to form separately housed devices. This would not have been ergonomic (more cables leading to more weight) and would be contrary to the attempt to reduce the coaxial cables taught by Leavitt, et al.

This is not a case of simple change in shape, portability or separability. The arrangement shown by Leavitt, et al. exists for good reason according to Leavitt, et al. The separation proposed by the Examiner as obvious would result in the very problems Leavitt, et

al. seek to avoid. A person of ordinary skill in the art would not have used cables between the components of the probe 106.

In response, the Examiner alleges that a cable would be a connection element with more than one wire, as the instant claims set does not specifically mention that a coaxial cable is required between elements. However, this simplification ignores the context of the claim. Claim 1 recites that the connector housing is spaced from the ultrasound transducer. The wires 204, 208, 212 relied on by the Examiner as the "cable" are within the probe assembly 106 (Figure 2), so are not spaced from the ultrasound transducer.

According to claim 1, the end of the cable connects to the connector housing. Leavitt, et al. provide the wires between the transducer and the ADC within the probe housing (Figure 2), not the connector housing. Leavitt, et al. do not show how the connection from the interface cables 104 to the processor 102 is arranged, so do not even show a connector housing. A person of ordinary skill in the art understands that the probe 106 of Leavitt, et al. is not a connector housing around a releasable connector. Since the end of the cable connects with the connector housing, the cables 204, 208, and 212 cannot be the recited cable.

If the cables 204, 208, and 212 are the recited cable, then these wires do not have an end connected with the connector housing. Wires 204 end at the transducer 202 and the switch 206. Wires 208 end at the switch 208 and the ASIC 210. Wires 212 end at the ASIC 210 and the ADC 212. None of these components are a connector housing spaced from an ultrasound transducer.

To the extent the wires 204, 208, and 212 are said to end at the probe 106, the probe 106 is not spaced from the ultrasound transducer. The probe 106 includes the ultrasound transducer.

To further clarify this distinction, claim 1 has been amended to recite that the cable is a coaxial cable. The Examiner relies on mere electrical connection in a same housing. Coaxial cables would not have been used for electrical connection within a probe housing due to space considerations.

Claim 1 has also been amended to recite that the coaxial cable has a length longer than a longest dimension of a probe housing housing the ultrasound transducer. Such length of cable would not be provided within the probe housing, so the electrical connection relied on by the Examiner is not appropriate.

Claim 1 also recites that at least part of the coaxial cable is outside of the connector housing and the probe housing. The electrical connection between the transducer and A/D converter in the same housing is not outside of the housing.

Independent claim 11 recites a detachable transducer assembly with an analog-to-digital converter in a connector housing, which is physically detachable from a connector on the system housing. As discussed above for claim 1, Leavitt, et al. position the analog-to-digital converter in the transducer housing, not in the connector housing with a cable between the connector housing and the transducer probe. It would not have been obvious to separate the analog-to-digital converters 214 from the transducers 202 with cables. Such separation would defeat minimization of cables from the probe 106 since the reduction does not occur until after the analog-to-digital converters.

The Examiner alleges that there is nothing requiring the transducer housing and connector housing to be separate. However, reading the connector and transducer housings as the same housing removes limitations from the claim, so is not proper. Claim 11 recites that a cable connects the probe with the connector housing. If the housings are the same, then there is no cable connecting them. Wires inside the housing do not connect one housing to another.

A person of ordinary skill in the art understands the connector housing and transducer probe of a detachable transducer assembly to be separate components. To read the components as the same housing ignores the separate recitation of the transducer probe housing an array and the connector housing connectable and detachable from the system housing.

Given the ordinary meaning of the connector housing and transducer probe or the cable connecting them, Leavitt, et al. do not show this arrangement. Reading the two separately recited housings, connected by a cable, as the same housing is not a correct interpretation.

To clarify this distinction, claim 11 has been amended to recite that the connector housing is separate from the transducer probe housing the array, and that the cable extends between the transducer probe and the connector housing outside of both the connector housing and the transducer probe. Leavitt, et al. provide the ADC in the probe housing to allow reduction of the cable size of the cable connecting the probe housing to the portable processor. The ADC would not have been located in a connector housing separate from the probe housing.

Independent claim 16 recites a processor connected between the transducer and releasable connector and in the housing of the releasable connector. As discussed above for claim 1, Leavitt, et al. disclose positioning the processing in the transducer housing, and then connecting the transducer housing to the imaging system with an interface cable (see col. 3, lines 37-52). Leavitt, et al. do not position any processor in the housing of the releasable connector. It would not have been obvious to position a processor in the releasable connector housing as the processing of the probe 106 has the goal of reducing channels and that goal is achieved by the components within the probe 106. Moving any of those components to the connector housing would result in no reduction of channels and a substantial increase in the number of cables, the very thing sought to be avoided by Leavitt, et al. A person of ordinary skill would not have positioned a processor in the housing of the releasable connector due to the signal reduction teachings in order to provide fewer interconnects as taught by Leavitt, et al.

The Examiner did not specifically address claim 16 in the Response to Arguments section of the Office Action. The processor of claim 16 is in the housing of the releasable

connector. Leavitt, et al. do not show any such releasable connector and housing of the releasable connector. The probe 106 is not disclosed as having a releasable connector.

Claim 16 has been amended for clarity. Claim 16 recites the use of two housings connected by a relatively longer cable. As discussed above, Leavitt, et al. do not disclose this arrangement where a processor is provided in the second of the housings connected by cable to the first of the housings.

Independent claim 20 has been amended to include the limitations of claim 21. In particular, claim 20 recites transmitting electrical signals through a cable of the probe assembly and converting the electrical signals into digital data within a connector housing of the probe assembly. Claim 20 is allowable for the same reasons as claim 1.

The Examiner alleges that there is nothing requiring the transducer housing and connector housing to be separate elements. However, the probe 106 of Leavitt, et al. is not a connector housing. Leavitt, et al. do not provide a connector and associated connector housing.

Claim 20 has been amended to clarify this distinction. The connector housing is recited as being separate from a probe housing housing transducers for performing transducing. The connector housing us spaced from the probe housing by the cable, and the cable is outside of the connector and probe housings. Leavitt, et al. do not provide for this transducer assembly arrangement where the converting occurs in the separate connector housing.

Dependent claims 2, 4-10, 12-15, 17, 19 and 22-24 each depend from one of the independent claims above, so is each allowable for at least the same reasons as the corresponding base claim. Further limitations distinguish from the cited references.

Claim 5 recites cables connecting transducer elements to analog-to-digital converters. Leavitt, et al. use cables between the probe assembly 106 and the imaging system 102. The elements and the analog-to-digital converters are on the same end (probe assembly 106) of

the cables. The analog-to-digital converters are before the sub-beamformer, so are before reduction of the signals. A person of ordinary skill in the art would not have positioned the cables between the elements and the analog-to-digital converters as increased weight from the larger number of cables would result. Reading the wires 204, 208, and 212 as the cables reads out limitations of the claim, such as the cable ending at the connector housing.

Claim 8 recites a digital processor between the analog-to-digital converter and the electrical outputs. Since the analog-to-digital converter is in the connector housing, Leavitt, et al. do not suggest this placement. The electrical outputs are of a connector according to claim 8. The probe 106 has no such connector, so the sub-beamformer 218 is not the processor with positioning recited in claim 8.

Claim 9 recites a switch between the ultrasound transducer and the analog-to-digital converter to bypass analog signals. Leavitt, et al. provide an alternative of an analog sub-beamformer (col. 11, lines 5-8). This embodiment would not even have the analog-to-digital converter and would not provide for a bypass. The T/R switch of col. 3, line 60-col. 4, line 20 is a known component for protecting sensitive receive circuits from high voltage transmit circuits, so blocks transmit signals from receive circuits. The T/R switch does not bypass analog signals to the outputs. The Examiner cites to the switch 206, but this T/R switch does not bypass analog signals. A T/R switch protects sensitive receive circuitry from high voltage transmit waveforms, not for bypassing analog signals to an output of a connector connected with the imaging system.

Claim 13 recites a combination of a multiplexer and demultiplexer where the demultiplexer is in the connector housing. Pflugrath, et al. multiplex and demultiplex to route signals from elements to different beamformer channels. The demultiplexer is not located in the connector housing, but instead in the probe housing. The dumultiplexer could not be located in the connector housing as the demultiplexer is used to protect the receive circuits from the transmit voltage, so is immediately adjacent to the elements of the transducer. The context of the claim provides for two housings with an interconnecting cable between the housings. Pflugrath, et al. do not provide for the demux in a connector housing.

Claim 14 recites a serializer housed by the connector housing. The Examiner cites to delay and focus components in the probe assembly, not the connector housing. The delay and focus components are not serializers.

Claim 15 recites a processor in the connector housing. Claim 15 is allowable for similar reasons as claim 16.

Claim 17 is allowable for similar reasons as claim 1.

Claim 23 recites time division multiplexing signals prior to transmission to the analog-to-digital converter and then demultiplexing the signals after converting and before passing. Pflugrath, et al. use multiplexing and demultiplexing for routing to beamformer channels to protect receive circuits from transmit voltage, so do not disclose the recited demultiplexing after ADC.

CONCLUSION:

Applicants respectfully submit that all of the pending claims are in condition for allowance and seeks early allowance thereof.

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